

REMARKS

Reconsideration is respectfully requested in view of any changes to the claims and the remarks herein. Please contact the undersigned to conduct a telephone interview in accordance with MPEP 713.01 to resolve any remaining requirements and/or issues prior to sending another Office Action. Relevant portions of MPEP 713.01 are included on the signature page of this amendment.

Add claims 486 to 491 corresponding to claims 364, 365, 368, 380, 383, 386, 389, 392, 394, 395, 396, 397, 398, 399, 400, 401, 403, 407, 408, 409, 410, 411, 412 and 413, respectively, with the term "perovskite characteristic" changed to "perovskite related structure."

Claim 32 has been amended to correct a typographical error. Claim 73 has been amended to change "including to "comprising". Claim 75 and claim 76 have been amended to be changed from a method claim to an apparatus claim. Claim 83 has been amended to change "method" to "apparatus". Claim 163 has been amended to change "including" to "comprising". Claim 189 has been amended to correct a typographical error. Claim 381 has been amended to change "including" to "comprising".

The rare earth elements are Sc, Y, La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, and Lu. See the Handbook of Chemistry and Physics 59th edition 1978-1979 page B262 in Appendix A. The transition elements are identified in the periodic table from the inside front cover of the Handbook of Chemistry and Physics in Appendix A.

Claims 428-430 have been added and are directed to an apparatus comprising “a superconductive element comprising a superconductive composition, said superconductive composition comprising O and element selected from the group consisting of Be, Mg, Ca, Sr, Ba, Ra, Sc, Y, La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, and Lu.”

The general principles of ceramic science referred to by Bednorz and Mueller in their patent application can be found in many books and articles published before their discovery, priority date and US Application filing date. An exemplary list of books referred to in the Declarations of Mitzi, Shaw, Dinger, Tsuei, and Duncombe describing the general principles of ceramic fabrication are:

- 1) Introduction to Ceramics, Kingery et al., Second Edition, John Wiley & Sons, 1976, in particular pages 5-20, 269-319, 381-447 and 448-513, a copy of which is with the Affidavit of Thomas Shaw submitted December 15, 1998.
- 2) Polar Dielectrics and Their Applications, Burfoot et al., University of California Press, 1979, in particular pages 13-33, a copy of which is with the Affidavit of Thomas Shaw submitted December 15, 1998.
- 3) Ceramic Processing Before Firing, Onoda et al., John Wiley & Sons, 1978, the entire book, a copy of which is with the Affidavit of Thomas Shaw submitted December 15, 1998.
- 4) Structure, Properties and Preparation of Perovskite-Type Compounds, F. S. Glasco, Pergamon Press, 1969, in particular pages 159-186, a copy of which is with the Affidavit of Thomas Shaw submitted December 15, 1998.

These references are attached hereto as Appendixes B, C, D, and E, respectively.

An exemplary list of articles applying the general principles of ceramic fabrication to the types of materials described in Applicants' specification are (these references are cited on applicant's 1449 form submitted August 5, 1987 and in PTO Form 892 in Paper #20, Examiner's Action dated August 8, 1990):

- 1) Oxygen Defect K_2NiF_4 - Type Oxides: The Compounds $La_{2-x}Sr_xCuO_{4-x/2+}$, Nguyen et al., Journal of Solid State Chemistry 39, 120-127 (1981).
- 2) The Oxygen Defect Perovskite $BaLa_4Cu_5O_{13.4}$, A Metallic Conductor, C. Michel et al., Mat. Res. Bull., Vol. 20, pp. 667-671, 1985.
- 3) Oxygen Intercalation in Mixed Valence Copper Oxides Related to the Perovskite, C. Michel et al., Revue de Chemie Minerale, p. 407, 1984.
- 4) Thermal Behaviour of Compositions in the Systems $x BaTiO_3 + (1-x) Ba(Ln_{0.5} B_{0.5}) O_3$, V.S. Chincholkar et al., Therm. Anal. 6th, Vol. 2., p. 251-6, 1980.

These references are attached hereto as Appendixes F, G, H, and I, respectively.

The specification in the paragraph bridging pages 6 and 7 states:

These compositions can carry supercurrents (i.e., electrical currents in a substantially zero resistance state of the composition) at temperatures greater than 26°K. In general, the compositions are characterized as mixed transition metal oxide systems where the transition metal oxide can

exhibit multivalent behavior. These compositions have a layer-type crystalline structure, often perovskite-like, and can contain a rare earth or rare earth-like element. A rare earth-like element (sometimes termed a near rare earth element) is one whose properties make it essentially a rare earth element. An example is a group IIIB element of the periodic table, such as La. Substitutions can be found in the rare earth (or rare earth-like) site or in the transition metal sites of the compositions. For example, the rare earth site can also include alkaline earth elements selected from group IIA of the periodic table, or a combination of rare earth or rare earth-like elements and alkaline earth elements. Examples of suitable alkaline earths include Ca, Sr, and Ba. The transition metal site can include a transition metal exhibiting mixed valent behavior, and can include more than one transition metal. A particularly good example of a suitable transition metal is copper. As will be apparent later, Cu-oxide based systems provide unique and excellent properties as high T_c superconductors. An example of a superconductive composition having high T_c is the composition represented by the formula RE-TM-O, where RE is a rare earth or rare earth-like element, TM is a nonmagnetic transition metal, and O is oxygen. Examples of transition metal elements include Cu, Ni, Cr etc. In particular, transition metals that can exhibit multi-valent states are very suitable. The rare earth elements are typically elements 58-71 of the periodic table, including Ce, Nd, etc.

In this passage the general formula is RE-TM-O “where RE is a rare earth or rare earth-like element, TM is a nonmagnetic transition metal, and O is oxygen.” This paragraph states “Substitutions can be found in the rare earth (or rare earth-like) site or in the transition metal sites of the compositions. For example, the rare earth site can also include alkaline earth elements selected from group IIA of the periodic table, or a combination of rare earth or rare earth-like elements and alkaline earth elements.” Thus applicants teach that RE can be something other than an rare earth. For example, it can be an alkaline earth, but is not limited to a alkaline earth element. It can

be an element that has the same effect as an alkaline earth or rare-earth element, that is a rare earth like element. Also, this passage teaches that TM can be substituted with another element, for example, but not limited to, a rare earth, alkaline earth or some other element that acts in place of the transition metal.

The following table is compiled from the Table 1 of the Article by Rao (Attachment C of the response submitted August 4, 2000) and the Table of high T_c materials from the "CRC Handbook of Chemistry and Physics" 2000-2001 Edition (Attachment 48 and 49 of the Fifth Supplementary Amendment data March 1, 2004.) An asterisk in column 3 indicated that the composition of column 1 does not come within the scope of the claims allowed in the Office Action of July 28, 2004.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|----|--|-------------|----------------------------|---|------------------------|--------------------|
| # | MATERIAL | RAO ARTICLE | HANDBOOK OF CHEM & PHYSICS | | ALKALINE EARTH ELEMENT | RARE EARTH ELEMENT |
| 1 | $\text{La}_2\text{CuO}_{4+\delta}$ | √ | √ | * | N | Y |
| 2 | $\text{La}_{2-x}\text{Sr}_x(\text{Ba}_x)\text{CuO}_4$ | √ | √ | | Y | Y |
| 3 | $\text{La}_2\text{Ca}_{1-x}\text{Sr}_x\text{Cu}_2\text{O}_6$ | √ | √ | | Y | Y |
| 4 | $\text{YBa}_2\text{Cu}_3\text{O}_7$ | √ | √ | | Y | Y |
| 5 | $\text{YBa}_2\text{Cu}_4\text{O}_8$ | √ | √ | | Y | Y |
| 6 | $\text{Y}_2\text{Ba}_4\text{Cu}_7\text{O}_{15}$ | √ | √ | | Y | Y |
| 7 | $\text{Bi}_2\text{Sr}_2\text{CuO}_6$ | √ | √ | * | Y | N |
| 8 | $\text{Bi}_2\text{CaSr}_2\text{Cu}_2\text{O}_8$ | √ | √ | * | Y | N |
| 9 | $\text{Bi}_2\text{Ca}_2\text{Sr}_2\text{Cu}_3\text{O}_{10}$ | √ | √ | * | Y | N |
| 10 | $\text{Bi}_2\text{Sr}_2(\text{Ln}_{1-x}\text{Ce}_x)_2\text{Cu}_2\text{O}_{10}$ | √ | √ | | Y | Y |
| 11 | $\text{Tl}_2\text{Ba}_2\text{CuO}_6$ | √ | √ | * | Y | N |
| 12 | $\text{Tl}_2\text{CaBa}_2\text{Cu}_2\text{O}_8$ | √ | √ | * | Y | N |
| 13 | $\text{Tl}_2\text{Ca}_2\text{Ba}_2\text{Cu}_3\text{O}_{10}$ | √ | √ | * | Y | N |
| 14 | $\text{Tl}(\text{BaLa})\text{CuO}_5$ | √ | √ | | Y | Y |
| 15 | $\text{Tl}(\text{SrLa})\text{CuO}_5$ | √ | √ | | Y | Y |
| 16 | $(\text{Tl}_{0.5}\text{Pb}_{0.5})\text{Sr}_2\text{CuO}_5$ | √ | √ | * | Y | N |
| 17 | $\text{TlCaBa}_2\text{Cu}_2\text{O}_7$ | √ | √ | * | Y | N |
| 18 | $(\text{Tl}_{0.5}\text{Pb}_{0.5})\text{CaSr}_2\text{Cu}_2\text{O}_7$ | √ | √ | * | Y | N |
| 19 | $\text{TlSr}_2\text{Y}_{0.5}\text{Ca}_{0.5}\text{Cu}_2\text{O}_7$ | √ | √ | | Y | Y |

| | | | | | | |
|----|--|---|---|---|---|---|
| 20 | TlCa ₂ Ba ₂ Cu ₃ O ₈ | √ | √ | * | Y | N |
| 21 | (Tl _{0.5} Pb _{0.5})Sr ₂ Ca ₂ Cu ₃ O ₉ | √ | √ | * | Y | N |
| 22 | TlBa ₂ (Ln _{1-x} Ce _x) ₂ Cu ₂ O ₉ | √ | √ | | Y | Y |
| 23 | Pb ₂ Sr ₂ Ln _{0.5} Ca _{0.5} Cu ₃ O ₈ | √ | √ | | Y | Y |
| 24 | Pb ₂ (Sr,La) ₂ Cu ₂ O ₆ | √ | √ | | Y | Y |
| 25 | (Pb,Cu)Sr ₂ (Ln,Ca)Cu ₂ O ₇ | √ | √ | | Y | Y |
| 26 | (Pb,Cu)(Sr,Eu)(Eu,Ce)Cu ₂ O _x | √ | √ | | Y | Y |
| 27 | Nd _{2-x} Ce _x CuO ₄ | √ | √ | * | N | Y |
| 28 | Ca _{1-x} Nd _x CuO ₂ | √ | | | Y | Y |
| 29 | Sr _{1-x} Nd _x CuO ₂ | √ | √ | | Y | Y |
| 30 | Ca _{1-x} Sr _x CuO ₂ | | √ | * | Y | N |
| 31 | Ba _{0.6} K _{0.4} BiO ₃ | | √ | * | Y | N |
| 32 | Rb ₂ C ₅ C ₆₀ | | √ | * | N | Y |
| 33 | NdBa ₂ Cu ₃ O ₇ | | √ | | Y | Y |
| 34 | SmBaSrCuO ₇ | | √ | | Y | Y |
| 35 | EuBaSrCu ₃ O ₇ | | √ | | Y | Y |
| 36 | BaSrCu ₃ O ₇ | | √ | * | Y | N |
| 37 | DyBaSrCu ₃ O ₇ | | √ | | Y | Y |
| 38 | HuBaSrCu ₃ O ₇ | | √ | | Y | Y |
| 39 | ErBaSrCu ₃ O ₇ (Multiphase) | | √ | | Y | Y |
| 40 | TmBaSrCu ₃ O ₇ (Multiphase) | | √ | | Y | Y |
| 41 | YBaSrCu ₃ O ₇ | | √ | * | Y | Y |
| 42 | HgBa ₂ CuO ₂ | | √ | * | Y | N |
| 43 | HgBa ₂ CaCu ₂ O ₆ (annealed in O ₂) | | √ | * | Y | N |
| 44 | HgBa ₂ Ca ₂ Cu ₃ O ₈ | | √ | * | Y | N |
| 45 | HgBa ₂ Ca ₃ Cu ₄ O ₁₀ | | √ | * | Y | N |

The first composition, La₂ Cu O_{4+δ}, has the form RE₂CuO₄ which is explicitly taught by applicants. The δ indicates that there is a nonstoichiometric amount of oxygen.

Applicants specification teaches at page 11, line 19 to page 12, line 7:

An example of a superconductive compound having a layer-type structure in accordance with the present invention is an oxide of the general composition RE₂TMO₄ where RE stands for the rare earths (lanthanides)

or rare earth-like elements and TM stands for a transition metal. In these compounds the RE portion can be partially substituted by one or more members of the alkaline earth group of elements. In these particular compounds, the oxygen content is at a deficit. For example, one such compound that meets this general description is lanthanum copper oxide La_2CuO_4 ...

Compound number 27 of the composite table contains Nd and Ce, both rare earth elements. All of the other compounds of the composite table, except for number 32, have O and one of the alkaline earth elements which as stated above is explicitly taught by applicants. (The rare earth elements are Sc, Y, La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, and Lu which as stated above is explicitly taught by applicants.) Compound 31 is a BiO_3 compound in which TM is substituted by another element, here Bi, as explicitly taught by Applicants in the paragraph quoted above.

The Examiner has given no reason for why Applicants are not entitled to claims covering what they have explicitly taught and enabled. The Examiner has merely deemed the non-allowed claims not enabled based on (1) the unsupported statement at page 6 of the Office Action that "It should be noted that at the time the invention was made, the theoretical mechanism of superconductivity in these materials was not well understood. That mechanism still is not understood," and (2) the Examiner statement at page 9:

The present specification actually shows that known forms of "a transition metal oxide", "a composition" and "a copper-oxide compound" do not show the onset of superconductivity at above 26°K. At p. 3, line 20, through p. 4, line 9, of their disclosure, the applicants state that the prior art includes a "Li- Ti-O system with superconducting onsets as high as 13.7°K." Official Notice is taken of the well-known fact that Ti is a transition metal. That disclosure also refers to "a second, non-conducting CuO phase" at p. 14, line 18.

As stated in Applicants' prior responses the basic theory of superconductivity has been known many years before Applicants' discovery. Notwithstanding, Applicants do not have to theoretically understand their invention to be entitled to claims that cover their teaching. Also, the existence of Li-Ti-O having a T_c less than 26°K does not mean that Applicants have not enabled $T_c \geq 26^\circ\text{K}$. As stated in the application's prior responses, the CCPA in *In re Angstadt* has stated that if the experimentation needed to identify compositions that do not come within the scope of a claim is not "undue experimentation", then the claim is enabled. Also the reference to "a second non-conducting CuO phase" at page 14, line 18, does not mean that Applicants have not enabled the claims since along with this non-conducting phase existed a phase having $T_c \geq 26^\circ\text{K}$. There is no statutory or decisional law basis for an Examiner "deeming" a patent claim not enabled. The Examiner has the burden of showing that based on the written description undue experimentation is needed to practice the claimed invention. The Examiner has not met this burden to establish a prima facie case of non enablement.

In the composite table, compound numbers 7 to 10 and 31 are Bismuth (Bi) compounds. Compound number 12 to 22 are Thallium (Tl) compounds. Compound numbers 23 to 26 are lead (Pb) compounds. Compounds 42 to 45 are Mercury (Hg) compounds. Those compounds that do not come within the scope of an allowed claim are primarily the Bi, Tl, Pb and Hg compounds. These compounds are made according to the principles of ceramic science known prior to applicant's filing date. For example, Attachments J, K, L, and M contain the following articles:

Attachment J - Phys. Rev. B. Vol. 38, No. 16, p. 6531 (1988) is directed to Thallium compounds.

Attachment K - Jap. Joun. of Appl. Phys., Vol. 27, No. 2, p. L209-L210 (1988) is directed to Bismuth (Bi) compounds.

Attachment L - Letter to Nature, Vol. 38, No. 2, p. 226 (18 March 1993) is directed to Mercury (Hg) compounds.

Attachment M - Nature, Vol. 336, p. 211 (17 November 1988) is directed to Lead (Pb) based compounds.

The article of Attachment J (directed to Tl compounds) states at page 6531, left column:

The samples were prepared by thoroughly mixing suitable amounts of Tl_2O_3 , CaO, BaO_2 , and CuO, and forming a pellet of this mixture under pressure. The pellet was then wrapped in gold foil, sealed in quartz tube containing slightly less than 1 atm of oxygen, and baked for approximately 3 h at $\approx 880^\circ C$.

This is according to the general principles of ceramic science known prior to applicant's priority date.

The article of Attachment K (directed to Bi compounds) states at page L209:

The Bi-Sr-Ca-Cu-O oxide samples were prepared from powder reagents of Bi_2O_3 , $SrCO_3$, $CaCO_3$ and CuO. The appropriate amounts of powders were mixed, calcined at $800-870^\circ C$ for 5 h, thoroughly reground and then cold-pressed into disk-shape pellets (20 mm in diameter and 2 mm in thickness) at a pressure of 2 ton. cm^2 . Most of the pellets were sintered at about $870^\circ C$ in air or in an oxygen atmosphere and then furnace-cooled to room temperature

This is according to the general principles of ceramic science known prior to applicant's priority date.

The article of Attachment L (directed to Hg compounds) states at page 226:

The samples were prepared by solid state reaction between stoichiometric mixtures of $\text{Ba}_2\text{CuO}_{3+\delta}$ and yellow HgO (98% purity, Aldrich). The precursor $\text{Ba}_2\text{CuO}_{3+\delta}$ was obtained by the same type of reaction between BaO_2 (95% purity, Aldrich) and CuO (NormalPur, Prolabo) at 930°C in oxygen, according to the procedure described by De Leeuw et al.⁶. The powders were ground in an agate mortar and placed in silica tubes. All these operations were carried out in a dry box. After evacuation, the tubes were sealed, placed in steel containers, as described in ref. 3, and heated for 5 h to reach ~800°C. The samples were then cooled in the furnace, reaching room temperature after ~10 h.

This is according to the general principles of ceramic science known prior to applicant's priority date.

The article of Attachment M (directed to Pb compounds) states at page 211, left column:

The preparative conditions for the new materials are considerably more stringent than for the previously known copper-based superconductors. Direct synthesis of members of this family by reaction of the component metal oxides or carbonates in air or oxygen at temperatures below 900°C is not possible because of the stability of the oxidized SrPbO_3 -based perovskite. Successful synthesis is accomplished by the reaction of PbO with pre-reacted (Sr, Ca, Ln) oxide precursors. The precursors are prepared from oxides and carbonates in the appropriate metal ratios, calcined for 16 hours (in dense Al_2O_3 crucibles) at 920-980°C in air with one intermediate grinding.

This is according to the principles of ceramic science known prior to applicant's priority date.

In Attachment U, there is a list of perovskite materials from pages 191 to 207 in the book "Structure, Properties and Preparation of Perovskite-Type Compounds" by F. S. Galasso, published in 1969, which is Attachment E hereto. This list contains about 300 compounds. Thus, what the term "Perovskite-type" means and how to make these compounds was well known to a person of ordinary skill in the art in 1969, more than 17 years before the Applicants' priority date.

This is clear evidence that a person of skill in the art knows (prior to Applicants' priority date) how to make the types of materials in Table 1 of the Rao Article and the Table from the Handbook of Chemistry and Physics as listed in the composite table above.

The standard reference "Landolt-Börnstein", Volumn 4, "Magnetic and Other Properties of Oxides and Related Compounds Part A" (1970) lists at page 148 to 206 Perovskite and Perovskite-related structures. (See Attachment N). Section 3.2 starting at page 190 is entitled "Descriptions of perovskite-related structures". The German title is "Perowvskite-ähnliche Structures". The German word "ähnliche" can be translated in English as "like". The Langenscheidt's German-English, English-German Dictionary 1970, at page 446 translates the English "like" as the German "ähnliche". (See Attachment O). Pages 126 to 147 of Attachment N describes "crystallographic and magnetic properties of perovskite and perovskite-related compounds", see title of Section 3 at page 126. Section 3.2.3.1 starting at page 192 of "Landholt-Börnstein" Vol. 4 (See Attachment N) is entitled "Bismuth Compounds". Thus Bismuth perovskite-like compounds and how to make them were well known more than 16 years prior to Applicants' priority date. Thus the "Landholt Börnstein" book published in 1970, more than 16 years before Applicants' priority date, shows that the term "perovskite-like" or "perovskite related" is understood by persons of skill in the art prior to Applicants' priority date. Moreover, the "Landholt-Börnstein" book cites references

for each compound listed. Thus a person of ordinary skill in the art knows how to make each of these compounds. Pages 376-380 of Attachment N has figures showing the crystal structure of compounds containing Bi and Pb.

The standard reference "Landolt-Börnstein, Volume 3, Ferro- and Antiferroelectric Substances" (1969) provides at pages 571-584 an index to substances. (See Attachment P). This list contains numerous Bi and Pb containing compounds. See, for example pages 578 and 582-584. Thus a person of ordinary skill in the art would be motivated by Applicants' teaching to fabricate Bi and/or Pb containing compounds that come within the scope of the Applicants' claims.

The standard reference "Landolt-Börnstein Volume 3 Ferro- and Antiferroelectric Substances" (1969) (See Attachment P) at page 37, section 1 is entitled "Perovskite-type oxides." This standard reference was published more than 17 years before Applicants' priority date. The properties of perovskite-type oxides are listed from pages 37 to 88. Thus the term perovskite-type was well known and understood by persons of skill in the art prior to Applicants' priority date and more than 17 years before Applicants' priority date persons of ordinary skill in the art knew how to make Bi, Pb and many other perovskite, perovskite-like, perovskite-related and perovskite-type compounds.

At page 14, line 10-15, Applicants' state "samples in the Ba-La-Cu-O system, when subjected to x-ray analysis, revealed three individual crystallographic phases V.12. a first layer-type perovskite-like phase, related to the K_2NiF_4 structure ..."

Applicants' priority document EP0275343A1 is entitled "New Superconductive Compounds of the K_2NiF_4 Structural Type Having a High Transition Temperature, and Method for Fabricating Same." The book "Structure and Properties of Inorganic Solids" by Francis S. Galasso, Pergamon Press (1969) at page 190 lists examples of Thallium (Tl) compounds in the K_2NiF_4 structure. (See Attachment Q). Thus based on Applicants' teachings, a person of ordinary skill in the art would be motivated to fabricate Thallium based compounds to test for high T_c superconductivity.

The book "Crystal Structures" Volume 4, by Ralph W. G. Wyckoff, Interscience Publishers, 1960 states at page 96 "This structure, like these of $\text{Bi}_4\text{Ti}_2\text{O}_{12}$ (IX, F_{12}) and $\text{Ba Bi}_4 \text{ Ti}_4 \text{ O}_4$ (XI, 13) is built up of alternating Bi_2O_2 and perovskite-like layers." Thus layer of perovskite-like Bismuth compounds was well known in the art in 1960 more than 26 years before Applicants' priority date. (See Attachment R).

The book "Modern Oxide Materials Preparation, Properties and Device Applications" edited by Cockayne and Jones, Academic Press (1972) states (See Attachment S) at page 155 under the heading "Layer Structure Oxides and Complex Compounds":

"A large number of layer structure compounds of general formula $(\text{Bi}_2\text{O}_2)^{2+} (\text{A}_{x-1}\text{B}_x\text{O}_{3x+1})^{2-}$ have been reported (Smolenskii et al. 1961; Subbarao, 1962), where A = Ca, Sr, Ba, Pb, etc., B = Ti, Nb, Ta and x = 2, 3, 4, or 5. The structure had been previously investigated by Aurivillius (1949) who described them in terms of Alternate $(\text{Bi}_2\text{O}_2)^{2+}$ layers and perovskite layers of oxygen octahedra. Few have been found to be ferroelectric and include $\text{SrBi}_2\text{Ta}_2\text{O}_9$ ($T_c = 583^\circ\text{K}$), $\text{PbBi}_2\text{Ta}_2\text{O}_9$ ($T_c = 703^\circ\text{K}$), $\text{BiBi}_3\text{Ti}_2\text{TiO}_{12}$ or $\text{Bi}_4\text{Ti}_3\text{O}_{12}$ ($T_c = 948^\circ\text{K}$), $\text{Ba}_2\text{Bi}_4\text{Ti}_5\text{O}_{18}$ ($T_c = 598^\circ\text{K}$) and $\text{Pb}_2\text{Bi}_4\text{Ti}_5\text{O}_{18}$ ($T_c = 583^\circ\text{K}$). Only bismuth titanate $\text{Bi}_4\text{Ti}_3\text{O}_{12}$ has been investigated in detail in the single crystal form and is finding applications in optical stores (Cummins, 1967) because of its unique ferroelectric-optical switching properties. The ceramics of other members have some interest because of their dielectric properties. More complex compounds and solid solutions are realizable in these layer structure oxides but none have significant practical application."

Thus the term layered oxides was well known and understood prior to Applicants' priority date. Moreover, layered Bi and Pb compounds were well known in 1972 more than 15 years before Applicants' priority date.

The standard reference "Landolt-Börnstein, Volume 3, Ferro and Antiferroelectric Substances" (1969) at pages 107 to 114 (See Attachment T) list "layer-structure oxides" and their properties. Thus the term "layered compounds" was well known in the art in 1969 more than 16 years prior to Applicants' priority date and how to make layered compounds was well known prior to applicants priority date.

Layer perovskite type Bi and Pb compounds closely related to the Bi and Pb high T_c compounds in the composite table above have been known for some time. For example, the following is a list of four articles which were published about 35 years prior to Applicants' filing date:

- (1) Attachment V - "Mixed bismuth oxides with layer lattices", B. Aurivillius, Arkiv Kemi 1, 463, (1950).
- (2) Attachment W - "Mixed bismuth oxides with layered lattices ", B. Aurivillius, Arkiv Kemi 1, 499, (1950).
- (3) Attachment X - "Mixed bismuth oxides with layered lattices ", B. Aurivillius, Arkiv Kemi 2, 519, (1951).
- (4) Attachment Y - "The structure of $\text{Bi}_2\text{NbO}_5\text{F}$ and isomorphous compounds", B. Aurivillius, Arkiv Kemi 5, 39, (1952).

These articles will be referred to as Aurivillius 1, 2, 3 and 4, respectively.

Attachment V (Aurivillius 1), at page 463, the first page, has the subtitle "I. The structure type of $\text{CaNb}_2\text{Bi}_2\text{O}_9$. Attachment V states at page 463:

X-ray analysis ... seemed to show that the structure was built up of Bi_2O_2^+ layers parallel to the basal plane and sheets of composition $\text{Bi}_2\text{Ti}_3\text{O}_{10}^-$. The atomic arrangement within the $\text{Bi}_2\text{Ti}_3\text{O}_{10}^-$ sheets seemed to be the

same as in structure of the perovskite type and the structure could then be described as consisting of Bi_2O_2^+ layers between which double perovskite layers are inserted.

Attachment V (Aurivillius 1) at page 464 has a section entitled " $\text{PbBi}_2\text{Nb}_2\text{O}_9$ Phase". And at page 471 has a section entitled " $\text{Bi}_3\text{NbTiO}_9$ ". And at page 475 has a table of compounds having the " $\text{CaBi}_2\text{Nb}_2\text{O}_9$ structure" listing the following compounds $\text{Bi}_3\text{NbTiO}_9$, $\text{Bi}_3\text{TaTiO}_9$, $\text{CaBi}_2\text{Nb}_2\text{O}_9$, $\text{SrBi}_2\text{Nb}_2\text{O}_9$, $\text{SrBi}_2\text{Ta}_2\text{O}_9$, $\text{BaBi}_2\text{Nb}_2\text{O}_9$, $\text{PbBi}_2\text{Nb}_2\text{O}_9$, $\text{NaBi}_5\text{Nb}_4\text{O}_{18}$, $\text{KBi}_5\text{Nb}_4\text{O}_{18}$. Thus Bi and Pb layered perovskite compounds were well known in the art about 35 years prior to Applicants' priority date.

Attachment W (Aurivillius 2) at page 499, the first page, has the subtitle "II Structure of $\text{Bi}_4\text{Ti}_3\text{O}_{12}$ ". And at page 510, Fig. 4 shows a crystal structure in which "A denotes a perovskite layer $\text{Bi}_2\text{Ti}_3\text{O}_{10}^-$, C Bi_2O_2^+ layers and B unit cells of the hypothetical perovskite structure BiTiO_3 .

Attachment X (Aurivillius 3) has at page 519, the first page, the subtitle "III Structure of $\text{BaBi}_4\text{Ti}_4\text{O}_{15}$ ". And in the first paragraph on page 519 states referring to the articles of Attachments V (Aurivillius 1), and W (Aurivillius 2) "X ray studies on the compounds $\text{CaBi}_2\text{Nb}_2\text{O}_9$ [the article of Attachment V] and $\text{Bi}_4\text{Ti}_3\text{O}_{12}$ [the article of Attachment W] have shown that the comparatively complicated chemical formulae of these compounds can be explained by simple layer structures being built up from Bi_2O_2^+ layers and perovskite layers. The unit cells are pictured schematically in Figs. 1a and 1c." And Fig. 4 at page 526 shows "One half of a unit cell of $\text{BaBi}_4\text{Ti}_4\text{O}_{15}$. A denotes the perovskite region and B the Me_2O_4 layer" where Me represents a metal atom.

Attachment Y (Aurivillius 4) is direct to structures having the $\text{Bi}_3\text{N}_{10}\text{O}_3\text{F}$ structure.

Attachment AA is a list of Hg containing solid state compounds from the 1989 Powder Diffraction File Index. Applicants do not have available to them an index from

prior to Applicants' priority date. The Powder Diffraction File list is a compilation of all known solid state compounds with reference to articles directed to the properties of these compositions and the methods of fabrication. From Attachment AA it can be seen, for example, that there are numerous examples of Hg based compounds. Similarly, there are examples of other compounds in the Powder Diffraction File. A person of ordinary skill in the art is aware of the Powder Diffraction File and can from this file find a reference providing details on how to fabricate these compounds. Thus persons of ordinary skill in the art would be motivated by Applicants' teaching to look to the Powder Diffraction File for examples of previously fabricated composition expected to have properties similar to those described in Applicants' teaching.

In the paragraph bridging pages 100-102 of the 5th Supplementary Amendment dated: March 1, 2004 Applicants state in regard to the book "Copper Oxide Superconductors" by Charles P. Poole, Jr., Timir Datta and Horacio A. Farach, John Wiley & Sons (1998), referred to herein as Poole 1988:

Applicants note that it is generally recognized that it is not difficult to fabricate transition metal oxides and in particular copper metal oxides that are superconductive after the discovery by Applicants of composition, such as transition metal oxides, are high T_c superconductors. Chapter 5 of the Poole et al. [Attachment 21] book entitled "Preparation and Characterization of Samples" states at page 59 "[c]opper oxide superconductors with a purity sufficient to exhibit zero resistivity or to demonstrate levitation (Early) are not difficult to synthesize. We believe that this is at least partially responsible for the explosive worldwide growth in these materials". Poole et al. further states at page 61 "[i]n this section three methods of preparation will be described, namely, the solid state, the coprecipitation, and the sol-gel techniques (Hatfi). The widely used solid-state technique permits off-the-shelf chemicals to be directly calcined into superconductors, and it requires little familiarity with the subtle physicochemical process involved in the transformation of a

mixture of compounds into a superconductor.” Poole et al. further states at pages 61-62 “[i]n the solid state reaction technique one starts with oxygen-rich compounds of the desired components such as oxides, nitrates or carbonates of Ba, Bi, La, Sr, Ti, Y or other elements. ... These compounds are mixed in the desired atomic ratios and ground to a fine powder to facilitate the calcination process. Then these room-temperature-stable salts are reacted by calcination for an extended period (~20hr) at elevated temperatures (~900°C). This process may be repeated several times, with pulverizing and mixing of the partially calcined material at each step.” This is generally the same as the specific examples provided by Applicants and as generally described at pages 8, line 19, to page 9, line 5, of Applicants’ specification which states “[t]he methods by which these superconductive compositions can be made can use known principals of ceramic fabrication, including the mixing of powders containing the rare earth or rare earth-like, alkaline earth, and transition metal elements, coprecipitation of these materials, and heating steps in oxygen or air. A particularly suitable superconducting material in accordance with this invention is one containing copper as the transition metal.” (See Attachment A of Applicants’ response dated May 14, 1998 [Attachment 23] and See Attachment H of Applicants’ response dated November 28, 1997 [Attachment 24]). Consequently, Applicants have fully enabled high T_c transition metal oxides and their claims.

Charles Poole et al. published another book in 1995 entitled "Superconductivity" Academic Press which has a Chapter 7 on "Perovskite and Cuprate Crystallographic Structures". (See Attachment Z). This book will be referred to as Poole 1995.

At page 179 of Poole 1995 states:

V. PEROVSKITE-TYPE SUPERCONDUCTING STRUCTURES

In their first report on high-temperature superconductors Bednorz and Müller (1986) referred to their samples as "metallic, oxygen-deficient ... perovskite-like mixed-valence copper compounds." Subsequent work has confirmed that the new superconductors do indeed possess these characteristics.

Thus Poole 1988 states that the high T_c superconducting materials "are not difficult to synthesize" and Poole 1995 states that "the new superconductors do indeed possess [the] characteristics" that Applicants' specification describes these new superconductors to have. Therefore, as of Applicants' priority date persons of skill in the art were enabled to practice Applicants' invention to the full scope that it is presently claimed, including in the claims that are not allowed.

In support of the Examiner's view that term such as "type" and "like" are indefinite under §112, the Examiner cites: Ex parte Remark, 15 USPQ 2d 1498, 1500 (BPAI 1990); Ex parte Kristensen, 10 USPQ 2d 1701, 1703 (BPAI 1989); Ex parte Attig, 7 USPQ 2d 1092, 1093 (BPAI 1988); and Ex parte Copenhaver, 109 USPQ 118 (POBA 1955).

Ex parte Remark is not on point since the Board found the term "and the like" in a claim to be indefinite under §112. Applicants claims do not use this terminology.

Ex parte Kristensen is not on point since the Board found the term "similar" in the phrase "for high pressure cleaning units or similar apparatus" in a claim indefinite under §112, second paragraph. Applicants do not use the terminology "or similar". The Board held with respect to the second paragraph of §112, the inquiry is "to determine whether the claims do, in fact, set out and circumscribe a particular area with a reasonable degree of precision and particularity". In the present application the terms "perovskite-like", "perovskite-type", "layered-like", "layered-type" and "rare-earth-like" are terms used in the art and these are well known and understood by a person of skill in the art.

Ex parte Attig is also not on point. The Board found the term “ZSM-5-type” indefinite under §112, second paragraph, because the prior art cited during prosecution gave different meanings to the term “ZSM-5-type”. But the Board did not find the use of the term “type” in a claim per se indefinite. The Board says “[i]t is true that the zeolites have been defined in various patents and claimed with the terminology “ZSM-5-type”. However, clearly the art of record in this case, all of it cited by applicants themselves, in the aggregate serve to render the term indefinite rather than definite”. 7 USPQ 1092, 1093. The Examiner has not shown that the terms “perovskite-like”, “perovskite-type”, “layered-like”, “layered-type” and “rare-earth-like” as used in applicants claims have different meanings in different cited prior art. To the contrary, Applicants have shown that these terms have a uniform meaning in the transition metal oxide high T_c art.

In Ex parte Copenhaver, the Board stated in regard to the terminology “Friedel-Graftz type” catalyst.

“[w]e are of the view that the word “type” when appended to another wise definite expression so extends the scope of such an expression as to render it objectionably indefinite from the stand point of patent law and procedures.”

We are not led to a different conclusion by the fact that the expression may have been used in certain technical and scientific publications which are not subject to the rigid legal requirements for definitions that apply to patent claims. The fact that the expression may have been used in claims of certain patents likewise does not alter our view on the question.”

Applicants note that Ex parte Copenhaver decided in 1955 was not cited by the Board in the later Board decisions cited by the Examiner. This decision has not been cited by any other Board or Court decision.

In view of the changes to the claims and the remarks herein, the Examiner is respectfully requested to reconsider the above-identified application. If the Examiner wishes to discuss the application further, or if additional information would be required, the undersigned will cooperate fully to assist in the prosecution of this application.

Please charge any fee necessary to enter this paper and any previous paper to deposit account 09-0468.

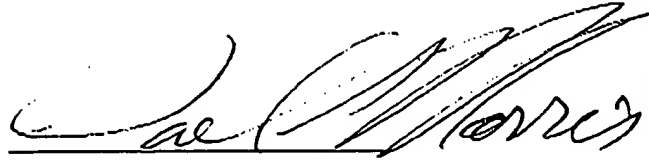
If the above-identified Examiner's Action is a final Action, and if the above-identified application will be abandoned without further action by Applicants, Applicants file a Notice of Appeal to the Board of Appeals and Interferences appealing the final rejection of the claims in the above-identified Examiner's Action. Please charge deposit account 09-0468 any fee necessary to enter such Notice of Appeal.

In the event that this amendment does not result in allowance of all such claims, the undersigned attorney respectfully requests a telephone interview at the Examiner's earliest convenience.

MPEP 713.01 states in part as follows:

Where the response to a first complete action includes a request for an interview or a telephone consultation to be initiated by the examiner, ... the examiner, as soon as he or she has considered the effect of the response, should grant such request if it appears that the interview or consultation would result in expediting the case to a final action.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Daniel P. Morris", written over a horizontal line.

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